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Device for Refilling Ink Receptacles  
in Ink Recording Means

Abstract

The invention relates to a device for refilling ink receptacles in multicolor printheads. In addition to the ink receptacles (2) arranged replaceable on the multicolor printhead, each containing in component receptacles (3,4,5,6) the different color ink, there is provided a refill receptacle (10) containing in the ink cartridge (11,12,13,14) a larger supply amount of ink differing in color. The outflow orifices (15) of the ink cartridges (11,12,13,14) are configured such that, after mounting the storage receptacle (2) removed from the printhead, a fluid communication sealed off from the outside exists between ink receptacle (2) and refill receptacle (10). Tilting the plugged-together receptacles (2, 10) results in the component receptacles (3,4,5,6) being filled by a slow replenishing flow.

Description

The invention relates to a device for refilling ink receptacles arranged replaceable in the printhead of ink recording means as set forth in the preamble of claim 1.

For fast, low-noise recording of characters of all kinds as well as for graphic representation, the so-called ink printing method has become popular. One such method is based on droplets of ink being jetted from ink passage-ways grouped together in a printhead and ending in outlet orifices, the ink droplets forming a mosaic composition of characters or graphic illustrations on a recording

medium. One example for a piezoelectric operated print-head for ink recording means is described in DE-OS 25 43 451.

For a colored recording it is known to supply the ink passageways with ink differing in color, it being sufficient to restrict selection to the four primary colors, preferably to inks having the colors yellow, magenta, cyan and black since by mixing these colors practically any color impression can be represented. In this arrangement, the ink supply receptacle of a colored ink jet printhead is configured such that the various colored inks are contained in separate receptacles which are arranged, however, in a common reservoir connected to and slaved in the movement of the printhead. One example of such a multicolor printhead is described in DE-OS 29 25 812.

In practical use of such multicolor printheads the ink consumption of a specific color is difficult to estimate beforehand, this relating in any case to the consumption of black ink since due to alphanumeric characters usually needing to be written more frequently the consumption of black ink is higher than the consumption of other color ink. The ink consumption of another color is more or less random and, as a rule, is subject to influencing factors which cannot be anticipated. This means that it is not possible to dimension the ink supply for a printhead right from the beginning so that each color is consumed more or less simultaneously, i.e. the ink receptacles containing the various colored inks are not emptied simultaneously. Since the ink receptacles of such printheads are usually provided as so-called throw-away articles, this means that ink receptacles still partly filled, need to be replaced and disposed of, just because only one ink receptacle containing an ink of a certain color has become empty.

Although it is possible to provide an amount of ink for each color corresponding to the statistical consumption in a stationary ink supply system, this would mean in devices including an ink receptacle slaved in the movement that a very large mass needs to be moved.

It is the objective of the invention to define simple handling means of refilling the component receptacles of an ink receptacle having become totally or partially empty in multicolor printheads in which the ink receptacle is slaved in the movement.

This objective is achieved in accordance with the characterizing features of claim 1.

Substantially, this involves the advantage that the ink receptacle containing the individual colored inks and slaved in the movement of the printhead can be maintained small in size and that it can be reused several times after refilling. The aspects of the ink receptacles arranged replaceable in the printhead as necessary for this purpose and the aspects of the refill receptacle can be produced at little expense. The use of two ink receptacles is sufficient to permit continued use of the printhead with no serious interruption even should any one color be subject to high consumption unanticipatedly.

Further aspects as cited in the sub-claims relate to the connection between the ink receptacle and the refill receptacle as well as to the configuration of the refill receptacle.

The invention will now be detailed with reference to the drawings in which

Fig. 1 is a diagrammatic illustration of a known print-head including an ink receptacle for multicolor printing,

Fig. 2 is a diagrammatic illustration of one example embodiment of the invention for an ink receptacle and a refill receptacle,

Fig. 3 is a diagrammatic illustration of an ink receptacle and refill receptacle during a refill or filling operation and

Fig. 4 is a diagrammatic illustration of one embodiment for achieving the fluid communication between ink receptacle and refill receptacle,

Referring now to Fig. 1 there is illustrated the basic configuration of a prior art printhead. Such a printhead comprises substantially the actual head part 1 in which the ink passageways and the drive elements assigned to the ink passageways, as a rule piezoelectric drive elements, are arranged. At its front end facing a recording medium (not shown) the head part comprises a series of outlet orifices from which droplets of ink are jetted by the effect of the drive elements against the paper. Constructively assigned to the printhead is the ink receptacle 2, replaceable in its entirety, and comprising four component receptacles for four different colors. These component receptacles are identified 3, 4, 5 and 6. They contain inks of the color yellow, magenta, cyan and black. Via an ink supply system 7 the ink passageways in the head part 1 are connected to the individual component receptacles 3, 4, 5 and 6. The complete arrangement is, as a rule, secured to a so-called carriage which is reciprocated along a printline in front of the recording medium. For ink recording means including the ink receptacle slaved in the movement this is designed in prior art as a so-called throw-away.

Referring now to Fig. 2 there is illustrated an example embodiment of the invention. Reference numeral 2 identifies therein the ink receptacle shown in section for removal from its mount on the printhead. This ink

receptacle 2 contains the four component receptacles 3, 4, 5 and 6, each of which consists of a flexible ink bag held between side walls. The component receptacles 3, 4 and 5 contain inks of the color yellow, magenta and cyan. The component receptacle 6 is larger in volume, it containing e.g. black ink. Each component receptacle includes an outflow orifice 8 which is closed off by a sealing plug 9. This sealing plug 9 is made of a rubber or silicone-like material through which a hollow needle can be inserted. It is usual practice that when mounting an ink receptacle 2 on the printhead that this sealing plug is pierced by a hollow needle arranged at the bottom of the printhead to thus make the connection to the ink supply system of the printhead. When the ink receptacle 2 is removed from the printhead, this removes the hollow needle from the sealing plug and the component receptacle is then closed off tight. Shown in the lower portion of Fig. 2 is a refill receptacle 10, likewise depicted in a section view. This consists of a series of ink cartridges 11, 12, 13 and 14, each of which contains a greater amount, e.g. tens times the amount of supply fluid, i.e. inks of the colors yellow, magenta, cyan and black, than that of the component receptacles. In this case too, the ink fluid is contained in flexible plastics wraps held by the sidewalls of the refill receptacle 10. Each ink cartridge comprises an outflow orifice 15 which is closed off by an elastomeric sealing ring 16. Protruding through this sealing ring 16 is a hollow needle 17, comprising an orifice 18 located in the region of its tip. In the example embodiment as shown in Fig. 2 the hollow needle 17 is arranged within the outflow orifice 15 on the refill receptacle 10. The orifices 8 of the ink receptacle 2 and the outflow orifices 15 of the refill receptacle 10 communicate such that when the ink receptacle 2 is mounted on the refill receptacle 10 the orifices 8 of the ink receptacle 2 are slidably received by the outflow orifices 15 of the refill receptacle 10, the hollow needle 17 thereby piercing the sealing plug 9. In the mounted condition, the orifice 18 of the hollow

needle 17 is located in the interior of the individual component receptacles 3, 4, 5 and 6 to thus produce a fluid connection, sealed off from the outside, between the refill receptacle 10 and the ink receptacle 2. The assembly formed by plugging together the ink receptacle 2 and the refill receptacle 10 is then tilted, as indicated symbolically in Fig. 3. Refilling the individual empty or partially empty component receptacles of the ink receptacle is then done by ink fluid slowly gaining access from the refill receptacle to the ink receptacle. When two ink receptacles are used, one of which is always in connection with the printhead whilst the other is connected to the refill receptacle in the way as described, the relatively long time needed for a refill operation is uncritical.

In the example embodiment as shown in Fig. 2 the orifice of the hollow needle is free when the ink receptacle is not mounted. This means that air is able to gain access to the ink cartridges or that ink fluid present in the orifice may crust which could be a nuisance to the fluid communication in later application. An improvement is achieved by the aspect of the invention as shown in Fig. 4. The detail shown therein merely depicts the outflow orifice 15 of a single ink cartridge and the orifice 8 of an ink receptacle. In the example as shown in Fig. 4 the outflow orifice 15 is achieved by an adapter which forms both the outflow orifice 15 and the hollow needle 17. This adapter can be secured by a simple screw connector 20. In this case the hollow needle 17 including the orifice 18 is surrounded by an elastomeric sealing material 21 which totally closes off the hollow needle in the region of its orifice as long as ink receptacle and refill receptacle are not plugged together. To refill an ink receptacle, the procedure is the same as described above which, with regard to the example as shown in Fig. 4, means that the orifice 8 is urged downwards into the orifice 15, resulting in the elastomeric sealing materials 9 and 21 being deformed and the hollow needle

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17 gaining access to the interior of the ink receptacle  
2. After tilting the complete arrangement, ink fluid  
flows slowly from the refill receptacle into the ink  
receptacle.

In accordance with a further aspect of the invention, the  
refill receptacle may be made up of individual plug-in,  
i.e. replaceably joined, ink cartridges whereby joining  
them together may be polarized to reliably prevent the  
individual ink cartridges being confused.

When, as proposed further by the invention, the ink  
cartridges of the refill receptacle are provided with an  
inspection window, or are made, right from the start, of  
a transparent material, then there is no need for  
additionally monitoring the fluid level.

4 claims

4 Figs.

## Claims

1. A device for refilling ink receptacles arranged replaceable in the printhead of ink recording means, each containing in separate component receptacles an ink of different color, characterized in that

a refill receptacle (10) having separate ink cartridges (11,12,13,14) is provided, each containing a larger supply of ink differing in color, each ink cartridge (11, 12, 13, 14) comprising an outflow orifice (15) each adapted to the outflow orifices (8) of said component receptacles (3,4,5,6) of said ink receptacle (2) such that said ink receptacle (2) can be plug-mounted on said refill receptacle (10), and that provided in the outflow orifice (15) of each ink cartridge (11,12,13,14) is a hollow needle (17) sealed off from the interior of said ink cartridge via which an outwardly fluid-tight flow communication exists after said ink receptacle (2) has been plug-mounted on said refill receptacle (10).

2. The device as set forth in claim 1, characterized in that

said outflow orifice (8) of said component receptacles (3,4,5,6) of said ink receptacle (2) and said outflow orifice (15) of said ink cartridges (11,12,13,14) of said refill receptacle (10) are each formed by an appendage which slide in each other when plugging together said ink receptacle (2) and said refill receptacle (10), that said hollow needle (17) is likewise arranged on said appendage forming said outflow orifices (15), this appendage being insertable into the wall of said refill receptacle (10), and that when said ink receptacle (2) is not mounted said elastomeric sealing material (21) of said outflow orifice (15) closes off said orifice (18) of said hollow needle (17).



3. The device as set forth in claim 1 and 2, characterized in that said ink cartridges (11,12,13,14) in said refill receptacle (10) are replaceable in their entirety.

4. The device as set forth in claim 1 and 2, characterized in that said ink cartridges (11,12,13,14) in said refill receptacle (10) are each individually replaceable and that each ink cartridge (11,12,13,14) is retained polarized in said refill receptacle (10).